OTT's Office of Fuels Development

Making cleaner, domestic fuels cost-effective for widespread use

U.S. DEPARTMENT OF ENERGY

OFFICE OF TRANSPORTATION TECHNOLOGIES

Transportation

FOR THE 21ST CENTURY

Championing the more widespread use of cleaner, domestically produced alternative fuels—either in pure form or in blends with traditional gasoline—is a key component of OTT's strategy to reduce our nation's dependence on oil imports. Indeed, ethanol, made primarily from corn, is already blended into over 10 percent of the gasoline sold in the United States, "invisibly" displacing a billion gallons of oil a year without any need for drastic changes in pumping infrastructure or vehicle design.

Significant opportunities exist to replace even greater amounts of imported oil with ethanol made from other domestic sources. Biomass feedstocks, such as residues left in the field after harvesting agricultural crops, contain cellulose that can be converted to sugars that are fermented to ethanol. Examples of crop residues include corn stalks and husks (the combined residues are called corn stover), wheat straw, and rice straw. The cumulative R&D efforts of industry, universities, and OFD projects at national laboratories resulted in notable technical advances over the past several years. For a limited number of low-cost biomass locations, industry already initiated design and engineering projects for first-generation biomass ethanol plants. However, much remains to be done in order to establish a major domestic biofuels industry.

The availability of abundant agricultural residues allows industry and OFD to focus on this category of feedstock in the near and mid term. OFD programs look to the longer term through their R&D of future bioenergy crops such as fast-growing grasses and trees, and biochemical technology for cheaply converting cellulose into sugars and subsequently fermenting the sugars to ethanol. Low-cost sugars would permit the production of valuable chemicals as co-products and can be viewed as a common "platform" for both transportation fuels and industrial chemicals. This is a key aspect of an integrated biomass industry that has the advantage of product stream flexibility combined with efficient biochemical processes. OFD also supports R&D to lower the cost of renewable diesel alternatives for heavy vehicle applications. The Regional Biomass Energy Program (RBEP) provides vital technology transfer and outreach in support of OFD's biofuels commercialization activities.

Cleaner, domestically abundant fuel—commercially competitive

OFD is assisting industry's efforts in building pioneer biomass ethanol plants that will use low cost biomass residues as feedstock, including municipal solid wastes and agricultural waste. Converting waste material to valuable liquid fuel can have environmental and economic benefits, using material that would otherwise be burned or landfilled. Converting wastes in several geographic areas would help build a new industry in many rural areas, with attendant economic and employment benefits.

OFD efforts involve developing biochemical processes that, when integrated end to end, allow the cost-effective conversion of biomass to fuel ethanol. Industry, universities, and OFD have been increasing cooperation in biomass pretreatment research with the objective of facilitating the subsequent hydrolysis processing operation. OFD and enzyme industry leaders initiated collaborative programs aimed at developing special enzymes that can quickly hydrolyze cellulose to sugars at a fraction of current estimated costs. Advanced bacteria and yeasts are being developed at universities, private laboratories, and national laboratories for the purpose of rapidly fermenting biomass sugars to ethanol.

The development of cost-effective renewable fuel for use in heavy vehicles continues to be a goal of OFD. OFD continues working on

Energy Efficiency and Renewable Energy's Office of Transportation Technologies (OTT) within the U.S. Department of Energy is charged with reducing America's dependence on petroleum, thereby bolstering the nation's energy security and improving the quality of its air. To meet that goal, OTT enters diverse, cost-shared R&D partnerships with like-minded organizations both public and private, helping develop technologies to a point where industry can commercialize them into marketable products. OTT is organized into four "sub" offices corresponding to major customer areas:

- *The Office of Advanced Automotive Technologies develops technologies that will lead to motor vehicles with greater fuel economy and lower emissions.*
- *The Office of Heavy Vehicle Technologies focuses on improving the efficiency of diesel engines for trucks, while simultaneously reducing emissions.*
- ***The Office of Fuels Development is primarily working to reduce the cost of cleaner, domestically- sourced ethanol, a renewable and easy-to-use alternative fuel.***
- *The Office of Technology Utilization is working to pave the way for market acceptance of new transportation technologies through educational, voluntary, and other practical efforts in partnership with industry stakeholders, local, and state government.*

research aimed at developing a cost-effective crop for renewable diesel production so that the biodiesel industry can expand beyond current niche markets. OFD is also evaluating other biomass-derived fuels for heavy duty vehicles in cooperation with OTT's Heavy Vehicle Technologies programs.

Ethanol for the future from dedicated energy crops

While relatively abundant, the U.S. supply of biomass residues is not inexhaustible. OFD has as an objective the establishment of future bioenergy crop supply systems consisting of specialized, fast growing grasses and trees. Properly planned bioenergy "plantations" would allow feedstock production, harvesting, and collection costs to be sufficiently attractive to support a large scale domestic biofuels industry. The Department of Agriculture, universities, and OFD have been collaborating on research and development over several years and have succeeded in increasing the per-acre yield of certain types of switchgrass and poplars.

Promoting regional biomass partnerships

OFD's Regional Biomass Energy Program (RBEP) relies on five strategically located regional offices within the continental United States. Working closely with state energy offices and other local partners, RBEP facilitates local biomass-based partnerships, coordinates educational workshops, disseminates biomass-related information, and engages in other activities to promote biomass production and use for transportation purposes. The Department of Energy's Biomass Power Program funds RBEP activities aimed at biomass power, and works closely with OFD in coordinating RBEP activities for maximum synergy.

For more information on how DOE is helping America remain competitive in the 21st century, please contact:

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